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No.

IN THE
Supreme Court of the United States

OCTOBER TERM 1983

ENVIRONMENTAL DESIGNS, LTD. AND
THE TRENTAM CORPORATION,

Petitioners,

v.

UNION OIL COMPANY OF CALIFORNIA AND
THE RALPH M. PARSONS COMPANY,

Respondents.

**PETITION FOR A WRIT OF CERTIORARI
TO THE UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT**

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October 26, 1983

QUESTIONS PRESENTED

1. Where Petitioner's process falls within the literal words of the claims but, based on the patentee's interpretation of certain words of the claims in the proceedings before the Patent Office, Petitioner's process is performed in a "substantially different way" from that of the patent, was the Court of Appeals correct in ignoring this Court's decision in *Graver Tank & Mfg. Co. v. Linde Air Products Co.*, 339 U.S. 605 (1950)?

2. Where a patentee placed a limitation on certain words of a patent claim during the proceedings in the U.S. Patent and Trademark Office, should such limitation be ignored in determining infringement because another claim has explicitly recited such limitation?

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UNION OIL COMPANY OF CALIFORNIA and
THE RALPH M. PARSONS COMPANY,

Respondents.

PETITION FOR WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

Petitioners respectfully pray that a Writ of Certiorari issue to review the judgment and opinion of the United States Court of Appeals for the Federal Circuit (CAFC) entered in the above-entitled case on July 25, 1983.

OPINIONS BELOW

The Opinion of the CAFC rendered July 25, 1983 is reported at 713 F.2d 693 (C.A.F.C. 1983) [Appendix A hereto (cited herein as Pet. App. A-1)]. The Findings of Fact and Conclusions of Law of the United States District Court for the Central District of California entered August 18, 1982 are not reported [Appendix B hereto (cited herein as Pet. App. B-1)]. The Judgment of the United States District Court for the Central District of California entered August 18, 1982 is Appendix C hereto (cited herein as Pet. App. C-1).

JURISDICTION

After the judgment of the CAFC was entered, a petition for rehearing was timely filed on August 6, 1983. The petition for rehearing was denied by an Order dated September 21, 1983 [Appendix D hereto (Pet. App. D-1)]. The jurisdiction of this Supreme Court is invoked pursuant to 28 U.S.C. §1254(1).

CONSTITUTIONAL AND STATUTORY PROVISIONS INVOLVED

This case involves Title 35, U.S.C. §271(a) which reads as follows:

"Except as otherwise provided in this title, whoever without authority makes, uses or sells any patented invention, within the United States during the term of a patent therefor, infringes the patent."

STATEMENT OF THE CASE

The federal jurisdiction of the United States District Court was invoked by Petitioners under Title 28 U.S.C. §1338. The action was initiated by Petitioners as a declaratory judgment action under Title 28 U.S.C. §§2201 and 2202.

The patent in suit is United States Patent No. 3,752,877 (Beavon) [Appendix E hereto includes the drawing (Pet. App. E-1) an excerpt from the specification (Pet. App. E-2) and claims 1 and 11 of the Beavon patent (Pet. App. E-3 and E-4)].

During the proceedings in the United States Patent and Trademark Office before the patent examiner, the language appearing as element (c) of claim 1 of the Beavon patent (Pet. App. E-3) was added by the applicant¹ and was continued until the final grant of the patent. The language of element (c) of claim 1 is as follows:

¹ The word "gas" was not initially in the phrase, but that is not an issue.

"(c) separating condensed water from the hydrogenated gas stream".

That language was added as a result of a rejection by the patent examiner because the applicant had not met the requirements of 35 U.S.C. §112. In making that rejection, the examiner stated as follows [Appendix F hereto (Pet. App. F)]:

"Reference claims 11 and 12 it is not apparent what utility exists in removing the water from the gas stream *prior to contact* with an aqueous solution." (Emphasis added.)

In response to that rejection, the applicant amended claims 1 and 14 by adding the language which now appears as element (c) in claim 1 of the patent as quoted above, and the applicant's attorney presented the following argument and explanation to the patent examiner [Appendix G hereto (Pet. App. G)]:

"As to claims 11 and 12, it should be evident from the disclosure that the presence of water in the gas stream would dilute an aqueous absorption solution. *Removing condensed water is now required by claims 1 and 14.* . . . In addition, the absorption solution will not be diluted by water of condensation nor consumed by chemical reaction with sulfur dioxide. . . .

Thus, it is respectfully submitted that *significant utility exists in removing water* and any trace amounts of sulfur dioxide from the gas stream *prior to contact with an aqueous absorption solution.*" (Emphasis added.)

Thus, the patentee's attorney expressly interpreted the language "separating condensed water from the hydrogenated stream" to require removal of the water "*prior to contact* with an aqueous absorption solution" although such words were not spelled out in the claim itself. The patent examiner never again raised that issue after the patentee's amendment to the claim accompanied by his interpretation. Throughout the rest of the proceedings, that interpretation was never changed.

Not only was that interpretation placed on the *claim* language, but the specification itself was amended by the filing

of a continuation-in-part application in which the patentee again emphasized that it was "important" to remove the water *prior to contact* with the absorption solution to (1) prevent dilution of the absorption solution and (2) to prevent consuming valuable treating chemicals by mixing them in the absorption solution (Pet. App. E-2).

It is undisputed that even though step (c) of claim 1 was literally carried out in Petitioners' process by "separating condensed water from the hydrogenated gas stream", *Petitioners did not separate the condensed water prior to contact with the absorption solution* and therefore Petitioners could not and did not get the two above-listed results of such prior removal.

REASONS FOR GRANTING THE WRIT

1. **Even Though The Supreme Court Doctrine Of Equivalents In Reverse In *Graver* Was Squarely Raised By Petitioner, The CAFC Did Not Even Mention It — By Its Silence, The CAFC Decided This Case In Conflict With The Supreme Court's Decision In *Graver*. This Court Should Review This Case Under Rule 17.1(c).**

The Supreme Court in *Graver Tank & Mfg. Co. v. Linde Air Products Co.*, 339 U.S. 605 (1950) stated at pages 608, 609:

"Thus, where a device is so far changed in principle from a patented article that it performs the same or a similar function in a *substantially different way*, but nevertheless falls within the literal words of the claim, the doctrine of equivalents may be used to restrict the claim and defeat the patentee's action for infringement. *Westinghouse v. Boyden Power Brake Co.*, 170 U.S. 537, 568, 18 S.Ct. 707, 722, 42 L.Ed. 1136." (Emphasis added.)

The above doctrine has been called the doctrine of "equivalents in reverse". The CAFC made no mention of that doctrine in its decision (Pet. App. A) even though Petitioners squarely raised it, both on appeal and in the petition for rehearing.

In the present case, the patentee not only amended the claim and interpreted the language of the amendment during the proceedings before the patent examiner, but he thereafter stated in the patent specification of a continuation-in-part application that it was "important" to remove the water for two reasons: (1) It prevented dilution of the treating absorption solution and (2) it eliminated the consumption of valuable treating chemicals (Pet. App. E-2). Those two results *cannot* be accomplished unless the removal of the condensed water is accomplished *prior to contact* of the condensed water with the absorption solution.

Petitioners urged before the CAFC, and now before this Court, that the *Graver* doctrine of equivalents in reverse applies here because even though the words in the patent claim may literally be read on Petitioners' process, there cannot be infringement under that doctrine since the wording of the claim has been *interpreted* by the patentee in the proceedings before the Patent Office to be a "substantially different way" from Petitioners' process.

Thus, based upon the patentee's undisputed interpretation of the patent claim language in step (c) of claim 1 *must be* carried out *prior to contact* of the water with the absorption solution. Since, in Petitioners' process, it is undisputed that the condensed water is *not* removed *prior to contact* with the absorption solution, Petitioner's process is carried out in a "substantially different way" from the Beavon patented process and there cannot be equivalency or infringement under the *Graver* decision.²

If the CAFC had followed *Graver*, it could not have found infringement of the Beavon patent by Petitioners, but the

² Although infringement is usually a fact question, where the facts are undisputed, the issue of infringement is a matter of law. *CS&M, Inc. v. Covington Brothers Technologies*, 678 F.2d 118 (9th Cir. 1982); *Cameron Iron Works, Inc. v. Stekoll*, 242 F.2d 17, 21 (5th Cir. 1957). Further, in *Kalman v. Kimberly-Clark Corp.*, 713 F.2d 760, 771 (C.A.F.C. 1983), the CAFC held that the application of "reverse equivalents" is a legal question.

CAFC, by its silence, refused to follow *Graver*. This case is therefore appropriate for review under Supreme Court Rule 17.1(c).

2. The CAFC's Reliance On The Differences In Claims Is Contrary To The Ninth Circuit Decision In *Kemart Corp. v. Printing Arts Research Labs, Inc.*, 301 F.2d 624 (9th Cir. 1953).

The CAFC pointed to the presence of claim 11 (Pet. App. E-4) which explicitly recited the separation of the water "prior to contact" with the absorption solution as "indicating that claim 1 was allowed without the phrase "prior to contact" for reasons other than the cited remarks made to the examiner." (Pet. App. A-12, 13). In reaching that conclusion, the CAFC relied upon a 1955 CCPA decision, *In re Rouso*, 106 U.S.P.Q. 108, 110 (Pet. App. A-13).

In re Rouso was not an infringement case, but instead was an appeal from the U.S. Patent and Trademark Office. The applicant there was attempting to have the Patent Office construe words in the claim to include specific steps disclosed in the specification. Other claims on appeal recited the specific steps, so the CCPA allowed only the claims to the specific steps.³ It was not a case such as here, where the applicant placed an interpretation on claim language to overcome a rejection, and which resulted in the examiner withdrawing the rejection.⁴

³ *Graver v. Linde* appears to have been mis-cited in *In re Rouso*, because no basis has been found in *Graver* to support the CCPA decision.

⁴ The CAFC also summarily dismissed the patentee's interpretation of the claim language because the rejection was on 35 U.S.C. § 112 rather than 35 U.S.C. § 103. Although courts have made that distinction under the "file wrapper estoppel" doctrine, there was no basis for the CAFC excluding an interpretation placed on the patent claims which established the lack of equivalency under *Graver*, as noted above.

Further, the Ninth Circuit in *Kemart Corp. v. Printing Arts Research Labs, Inc.*, 201 F.2d 624 (9th Cir. 1953) when asked to rule that a limitation present in one claim should not be read into another claim, held directly contrary to the CAFC's decision in this case, as follows:

"But this rule of construction is subordinate to the controlling rule that a patentee's broadest claim can be no broader than his actual invention, no matter how it may be expressed or what other claim his patent may contain."

The CAFC also ignored the Ninth Circuit *Kemart* case.

CONCLUSION

The Supreme Court decisions, and decisions by other Courts of Appeals should not be set aside by the CAFC without review by this Court. Even though the CAFC should be the court of last resort in most patent cases, that should not be the case when decisions of this Court and Courts of Appeals other than the CAFC are being reversed by the CAFC either directly or by silently ignoring them.

For each of the foregoing reasons, a writ of certiorari should issue to review the decision of the Court of Appeals for the Federal Circuit in this case.

Respectfully submitted,

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October 26, 1983

CERTIFICATE OF SERVICE

I hereby certify that on this 26th day of October, 1983, three copies of this Petition for Writ of Certiorari were mailed, via first class mail, postage prepaid, to Andrew J. Belansky, Esq., John T. Grinnell, Esq. and Leo J. Young, of the law firm of Christie Parker & Hale, 201 South Lake Avenue, Pasadena, California 91101. I further certify that all parties requiring to be served have been served.

.....
B. R. Pravel
Attorney for Petitioners

APPENDIX

APPENDIX A
UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

APPEAL NO. 83-554

ENVIRONMENTAL DESIGNS, LTD. AND THE TRENTHAM
CORPORATION,

Appellants,

v.

UNION OIL COMPANY OF CALIFORNIA AND RALPH M.
PARSONS CO.,

Appellees.

DECIDED: July 25, 1983

Before MARKEY, *Chief Judge*, DAVIS and BALDWIN, *Circuit Judges*.

MARKEY, *Chief Judge*.

Appeal from a judgment of the District Court for the Central District of California holding claims 1-8 and 12 valid and infringed. We affirm.

Background

In early 1975, Trentham Corporation (Trentham), the sole general partner of Environmental Designs, Ltd. (Environmental), announced the construction of an effluent gas treating plant using the Trencor process. On March 22, 1976, Environmental sought a declaratory judgment that U.S. Patent 3,752,877 ('877) for an effluent gas treating process known as the Beavon process, owned by Ralph M. Parsons Co. (Parsons) and licensed through the Union Oil Co. of California (Union), was invalid. Parsons and Union counterclaimed for infringement of claims 1-8 and 12. Trentham was joined as counterclaim defendant on March 17, 1978. Judge Pfaelzer tried the case during August and September of 1979 and entered judgment on August 18, 1982, holding the '877 patent valid and claims 1-8 and 12 infringed, enjoining Environmental and Trentham from

infringing the claims of the '877 patent, and awarding Parsons and Union damages of \$14,000.00.¹ Environmental and Trentham appeal from the holding of validity and infringement.

The Invention

The established Claus process removes about 97% of an atmospheric pollutant (sulfur) from a gas stream. The Beavon process of the '877 patent in suit and the accused Trencor process remove the remaining 3% of the sulfur from the Claus process effluent.

The sulfur in the effluent includes elemental sulfur (S), hydrogen sulfide (H_2S), sulfur dioxide (SO_2), carbonyl sulfide (COS), and carbon disulfide (CS_2). The Beavon process uses hydrogenation in catalytically converting sulfur dioxide and elemental sulfur into hydrogen sulfide and simultaneously uses hydrolysis in catalytically converting carbonyl sulfide and carbon disulfide into hydrogen sulfide. The resulting effluent is then treated for removal of a single compound, hydrogen sulfide, rather than for the removal of several compounds present before the Beavon process is performed. The total amount of sulfur removed by the Claus and Beavon processes is 99.5% or more.

The '877 patent contains 12 claims of which claim 1 is representative:

1. A continuous process for reducing the sulfur content of effluent gas streams containing water, sulfur dioxide, carbonyl sulfide and carbon disulfide which comprises the steps of:

- (a)(i) enriching the effluent gas stream with a source of hydrogen to a level which is at least equal to the stoichiometric amount of hydrogen required to convert the contained sulfur dioxide to hydrogen sulfide and water and sulfur to hydrogen sulfide and

¹ A Trentham antitrust counterclaim was dismissed. A motion to add findings was filed by Environmental and Trentham. The court, after a hearing, denied the motion.

(ii) catalytically hydrogenating at least essentially all of the contained sulfur dioxide to hydrogen sulfide and water and sulfur to hydrogen sulfide and

(iii) simultaneously hydrolyzing carbonyl sulfide and carbon disulfide to hydrogen sulfide at a temperature from about 300 to about 800°F.,

(iv) whereby contained water and water formed in the hydrogenation of sulfur dioxide to hydrogen sulfide are utilized for the hydrolysis of carbonyl sulfide and carbon disulfide;

(b) cooling the hydrogenated gas stream to at least the dew point of water to condense water;

(c) separating condensed water from the hydrogenated gas stream; and

(d) treating the cooling hydrogenated gas stream to remove hydrogen sulfide.

Issues

Did Judge Pfaelzer err: (1) in holding the '877 patent valid; (2) in holding that the '877 patent is not unenforceable for fraud on the Patent and Trademark Office (PTO); or (3) in finding that the Trencor process infringes the '877 patent?

Opinion

Judge Pfaelzer entered 104 findings of fact and 18 conclusions of law. Environmental has failed to show that any of these findings were clearly erroneous or that any of those conclusions were either unsupported in the record or contrary to law.

1. Validity

The sole basis for Environmental's attack on validity of the '877 patent lies in its assertion that the invention would have been obvious under 35 U.S.C. § 103.²

² 35 U.S. 103 provides:

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person

Obviousness is a conclusion of law based upon fact determinations. As set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 17, 148 USPQ 459, 467 (1966), and in *Stevenson v. U.S. International Trade Commission*, 612 F.2d 546, 549, 204 USPQ 276, 279 (CCPA 1979), those fact determinations involve (1) the scope and content of the prior art, (2) the differences between the prior art and the claimed invention, (3) the level of ordinary skill in the pertinent art, and (4) additional evidence, which may serve as indicia of non-obviousness. As is or should be true with every performance of the judicial process, all relevant evidence on each dispositive issue must be fully considered and evaluated. When a patent is challenged on the ground that the claimed invention would have been obvious, all evidence relevant to the obvious-nonobvious issue must be considered. *In re Sernaker*, 702 F.2d 989, 996, 217 USPQ 1, 7 (Fed. Cir. 1983).

Scope and Content of the Prior Art

It is undisputed that the prior art consists of that considered by the PTO and the eleven U.S. and foreign patents, and six technical articles and brochures cited by Environmental at trial. Of the art cited by the PTO, the most pertinent are U.S. Patent 2,361,825 ('825) to Doumani, an article by Doumani in *Industrial and Engineering Chemistry*, and Australian Patent No. 223,904 ('904) to Thumm. Of the art cited at trial, the most pertinent are British patents 952,555 ('555) and 1,018,630 ('630), chapter 13 of the book *Gas Purification* by Kohl and Riesenfeld, and an article entitled "Hydrogen Sulfide Production from Sulfur and Hydrocarbons" by Bacon and Boe.

The Doumani references disclose the reduction of sulfur dioxide with hydrogen and that all sulfur dioxide will be converted to hydrogen sulfide when the ratio of hydrogen to sulfur dioxide is three or greater.

having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The Thumm '904 patent discloses treatment of a Claus process effluent containing sulfur dioxide, hydrogen sulfide, carbonyl sulfide, carbon disulfide and water vapor to vaporize elemental sulfur for discharge from the reactor with the gas stream. Thumm describes addition of steam to the effluent to hydrolyze carbonyl sulfide and carbon disulfide to hydrogen sulfide, and teaches that the hydrolysis occurs simultaneously with the Claus reaction.

The PTO thus had before it prior art which disclosed the hydrogenation of sulfur dioxide to hydrogen sulfide (Doumani); the hydrolysis of carbonyl sulfide and carbon disulfide to hydrogen sulfide (Thumm); simultaneity of certain chemical reactions (Thumm); and the composition of the Claus effluent (Thumm).

The '555 patent discloses hydrolysis of carbonyl sulfide and a simultaneous conversion of carbon monoxide with water to form hydrogen and carbon dioxide.

The '630 patent discloses hydrolysis of carbonyl sulfide and hydrogenation or hydrogenative decomposition of other, unspecified impurities present in gases "obtained by partial combustion of carbonaceous combustible materials".

The Kohl and Riesenfeld book generally discloses hydrolysis of organic sulfur compounds and the basic reactions for hydrolysis of carbonyl sulfide and carbon disulfide. It includes a passing reference to hydrogenation of sulfur dioxide.

The Bacon and Boe article discloses a process for commercial production of hydrogen sulfide. At one point in the reaction, the hydrolysis of carbon disulfide and a reaction involving methane and sulfur proceed simultaneously.

Differences Between the Prior Art and the Claimed Invention

The Doumani references deal with a sulfur dioxide feed stream containing none of the other sulfur compounds found in

the Claus effluent. It provides no indication that hydrogenation of sulfur dioxide and sulfur would or could proceed simultaneously with hydrolysis of carbonyl sulfide and carbon disulfide.

The Thumm reference discloses simultaneous hydrolysis of carbonyl sulfide and carbon disulfide, but says nothing about hydrogenation of sulfur dioxide and sulfur.

The teachings of the Thumm and Doumani references provide no indication that the specific hydrogenation and hydrolysis reactions of the '877 patent will occur simultaneously or that those reactions should be used in treating a Claus effluent.

The feed stream disclosed in the '555 patent contains neither sulfur dioxide or sulfur. There is no suggestion in the '555 patent that hydrogenation of sulfur dioxide and sulfur would be essentially complete as required by the Beavon process.

The feed stream disclosed in the '630 patent contains no sulfur dioxide. There is no suggestion in that patent of essentially complete hydrogenation of sulfur dioxide, coupled with hydrolysis of carbonyl sulfide and carbon disulfide, as required by the Beavon process.

The feed materials of the Bacon and Boe article are only methane and sulfur. The feed materials of the Beavon process include no methane but include sulfur dioxide, hydrogen sulfide, carbonyl sulfide, and carbon disulfide.

Judge Pfaelzer found the prior art cited by Environmental cumulative, adding nothing to the art cited by the PTO. Environmental has not shown error in that finding.³

³ Environmental argues that the '630 patent teaches simultaneous hydrolysis of carbonyl sulfide with hydrogenation of other impurities and thus is prior art not considered by the PTO. The '630 patent, however, does not teach simultaneous hydrolysis of carbonyl sulfide with hydrogenation of the specific impurities found in Claus effluents or that those reactions will take place simultaneously in the environment of a Claus reactor. Thus, the '630 patent adds nothing more pertinent to the art cited by the PTO.

Level of Ordinary Skill

Factors that may be considered in determining level of ordinary skill in the art include: (1) the educational level of the inventor; (2) type of problems encountered in the art; (3) prior art solutions to those problems; (4) rapidity with which innovations are made; (5) sophistication of the technology; and (6) educational level of active workers in the field. *Orthopedic Equipment Co., Inc. v. All Orthopedic Appliances, Inc.*, Appeal Nos. 83-513, 83-525 Slip op. at 13 (Fed. Cir. May 16, 1983). Not all such factors may be present in every case, and one or more of these or other factors may predominate in a particular case. The important consideration lies in the need to adhere to the statute, *i.e.*, to hold that an invention would or would not have been obvious, as a whole, when it was made, to a person of "ordinary skill in the art" — not to the judge, or to a layman, or to those skilled in remote arts, or to geniuses in the art at hand.

Judge Pfaelzer discussed various factors involved in determining ordinary skill in the art, but did not specify a particular level applicable here. Nor need she have done so, for the parties are in agreement that their respective chemical expert witnesses with extensive backgrounds in sulfur chemistry are persons of ordinary skill in the art.⁴

Additional Evidence

Judge Pfaelzer found that the Beavon process of the '877 satisfied a long felt, but unfilled need because for the first time it enabled governmental bodies, *e.g.*, Los Angeles County, to adopt more stringent regulations for controlling sulfur dioxide emissions. She found that the invention achieved commercial success because a large percentage of the Claus effluent treating plants

⁴ Environmental argues that Fred Riesensfeld, a Parsons employee who made an abandoned disclosure of a process similar to the Beavon process should have been included. That consideration, however, would not have resulted in a level of skill in the art different from that of the parties' experts.

in the U.S. are based on the Beavon process. Environmental claims the need and commercial success were artificially generated by clean air legislation and should therefore not be considered.⁴

That the need was legislatively recognized in this case does not militate against its existence. There was a long felt need to remove as much sulfur as possible from the air we breathe. Judge Pfaelzer found that in 1948, the Air Pollution Control District (APCD) for Los Angeles County approved the first regulation limiting the amount of sulfur dioxide to 2000 ppm. Claus plants were exempt from the regulation because even though they emitted approximately 115 tons of sulfur dioxide into the atmosphere per day, they prevented the emission of 885 tons of sulfur dioxide per day. APCD could not tighten its regulation because "known technical means of accomplishing the desired results" were not available. Judge Pfaelzer entered extensive findings reflecting recognition of the need and the failed efforts of others over time to meet the need. Despite meetings with the affected companies, studies of all known methods, research reports by governments and industries (including Trencor), no solution emerged until the Beavon process was invented.

Environmental has not shown the findings on long felt need to have been erroneous. Nor could it do so by mere citation of legislative recognition. That the desire of governmental bodies to mandate higher purity standards was frustrated by lack of technology thus dramatizes the need. This was not a situation in which an invention lay about unneeded until legislation was passed to create a need. That the Beavon process filled a pre-

⁴ Whether the Beavon process achieved commercial success because legislatively impelled need not be decided in this case. Judge Pfaelzer did not give excessive weight to the finding. If she had, and if that had been error, it would have been harmless in light of all the evidence supporting her conclusion that the '877 patent is valid.

existing need and thereby freed legislatures to achieve their long-standing goal is strong evidence of nonobviousness.

As Judge Pfaelzer noted, highly probative evidence of nonobviousness resides in the expressions of disbelief by the chemical experts for both sides (Dr. Lana for Parsons; Dr. Hyne for Environmental). Before learning of the Beavon process, and with knowledge of earlier failed efforts, both stated unequivocally that they believed the reduction of sulfur compounds to hydrogen sulfide would not adequately solve the problem.⁶ Expressions of disbelief by experts constitute strong evidence of nonobviousness. *United States v. Adams*, 383 U.S. 39, 52 (1966).

Finally, Environmental points to three independent conceptions including the Riesenfeld disclosure, *supra* n.4, an asserted 1966 proposal by Trentham's president to simultaneously hydrogenate sulfur dioxide and hydrolyze carbonyl sulfide, and the work of Shell Internationale which resulted in U.K. Patent 1,332,337 for a similar process. We need not discuss those conceptions here, for we agree with Judge Pfaelzer that the evidence concerning them is of insufficient probative force to establish obviousness.⁷

Conclusion on Obviousness

All the pieces of the present invention were known in the art, *i.e.*, the equations for hydrogenation and hydrolysis of sulfur compounds, the simultaneity of chemical reactions, and the components of the Claus effluent. That all elements of an invention may have been old (the normal situation), or some old and some

⁶ Dr. Lana testified that he had believed conversion of sulfur compounds to hydrogen sulfide was the wrong direction to go. In a technical article, Dr. Hyne express skepticism of replacing one toxic component of the effluent with another toxic component.

⁷ The virtually simultaneous making of the same invention does not in itself preclude patentability of that invention. Hence, the entirety of what is known as interference practice. 35 U.S.C. § 135.

new, or all new, is however, simply irrelevant. Virtually all inventions are combinations and virtually all are combinations of old elements. A court must consider what the prior art as a whole would have suggested to one skilled in the art, *In re McLaughlin*, 443 F.2d 1392, 1395, 170 USPQ 209, 212 (CCPA 1971). Judge Pfaelzer did just that. She then properly and fully considered all the evidence of record bearing on the validity issue, finding that the Beavon process filled a long felt need and had been denigrated by the experts. Her conclusion that the invention as a whole would not have been obvious at the time it was made to one of ordinary skill in the art was eminently correct.

2. Fraud

A party asserting the defense of fraud bears a heavy burden of proof which must be met by clear and convincing evidence. *Nelson v. Bowler*, 626 F.2d 853, 858, 206 USPQ 881, 885 (CCPA 1980); *Norton v. Curtiss*, 433 F.2d 779, 797, 167 USPQ 532, 546-47 (CCPA 1970); *Orthopedic Equipment Co.*, *supra*, at 18. Environmental argues that Parsons committed fraud on the PTO by failing to bring the Riesenfeld disclosure, *supra* note 4, and page 443 from the book *Gas Purification* to the attention of the PTO.

There was no duty, however, to bring to the attention of the PTO the Riesenfeld disclosure because it was a mere "conception" and was admittedly not prior art. Parsons did submit an affidavit by Riesenfeld setting forth Riesenfeld's opinion that the Beavon process would not have been obvious. That prosecution of a patent application is *ex parte*, involving PTO reliance on the candor and good faith of a patent applicant, requires that an affidavit should be accompanied by information known to the affiant and inconsistent with the affidavit. That Riesenfeld's disclosure was not prior art and that Riesenfeld could well have

believed the process nonobvious under 35 U.S.C. 103, notwithstanding his disclosure, indicate that failure to report the disclosure did not constitute fraud. Withheld information must be material, a condition we find here lacking. The disclosure not being prior art, it would not have been material to the patentability of the Beavon process.

Lastly, Parsons submitted page 444 from the book "Gas Purification" to the PTO. It did not submit page 443 which showed reactions for hydrolysis of carbonyl sulfide and carbon disulfide. Failure to submit page 443 is not evidence of fraud, however. It is undisputed that those reactions were known and were of record before the examiner in the PTO when page 444 was submitted. Fraud cannot consist of a failure to duplicate what is in the file wrapper.

Similarly, that Parsons represented computer examples as "operating" examples does not evidence fraud. When a second example was added to the application, and representations were made to the PTO, a pilot plant was operating and producing operating results that confirmed the computer examples. A report of those operational results is part of the file wrapper.

Judge Pfaelzer correctly found that Environmental failed to meet its burden of showing by clear and convincing evidence that Parsons committed fraud on the PTO.

3. *Infringement*

Environmental's Trencor process is a Claus effluent treating process. Judge Pfaelzer found that it includes the identical steps, i.e., hydrogenation, hydrolyzing, cooling, separating water, and removing hydrogen sulfide, as those of the process set forth in Claims 1-8 and 12 of the '877 patent, and that it thus falls squarely within the literal boundaries of the claims and constitutes infringement. Environmental has not shown error in the finding that the Trencor process is the same as, operates the

same as, and achieves the same result as the claimed process. It thus constitutes not only literal but substantive infringement.

Environmental nevertheless seeks to avoid infringement on the ground that claim 1 must be read as including an unstated limitation ((c) separating condensed water from the hydrogenated gas stream *prior to contact with an aqueous absorption solution*) not involved in the Trencor process. Environmental says the claims must be interpreted in light of the specification and that Parsons is estopped from asserting the claim without that limitation because it made certain remarks to the examiner in overcoming a rejection under 35 U.S.C. § 112.⁸ Neither argument is persuasive.

The specification must be sufficiently explicit and complete to enable one skilled in the art to practice the invention, while a claim defines only that which the patentee regards as his invention. 35 U.S.C. § 112. The claim, not the specification, measures the invention, *Continental Paper Bag Co. v. Eastern Paper Bag Co.*, 210 U.S. 405, 420 (1908). Environmental's argument that claim 1 must include a limitation found in the specification is thus legally unsound. *Smith v. Snow*, 294 U.S. 1 (1935).

Equally unsound is Environmental's argument that Parsons is estopped from asserting the plain language of the claim by its remarks to the examiner. Those remarks were made to overcome a § 112 rejection, not to overcome a § 103 rejection based on prior art. Nothing of record indicates that a failure to include the "prior to . . . solution" phrase would have caused continuation of the § 112 rejection, or that claim 1 as it stands is in any manner vague, indefinite, or lacking in utility. Moreover, as Judge Pfaelzer recognized, the phrase omitted from claim 1 is specifically included in claim 11, indicating that claim 1 was

⁸ Parsons' remarks were: "Thus, it is respectfully submitted that significant utility exists in removing water and any trace amounts of sulfur dioxide from the gas stream prior to contact with an aqueous absorption solution".

allowed without the phrase for reasons other than the cited remarks made to the examiner. *Smith*, supra, at 13. It is improper for courts to read into an independent claim a limitation explicitly set forth in another claim. *In re Rouso*, 106 USPQ 108, 110 (CCPA 1955). Judge Pfaelzer did not err in finding infringement of claims 1-8 and 12.

Conclusion

The judgment that the claims of the '877 patent are valid⁹ and claims 1-8 and 12 are literally and substantively infringed by the Trencor process, is affirmed.

AFFIRMED

⁹ It is not necessary that a district court hold a patent valid. In an appropriate case, it is necessary to hold only that the challenger of a patent's validity failed to carry his burden of proving invalidity. 35 U.S.C. § 282. The result is the same, but the latter holding more accurately dramatizes that it, like all holdings, is based on the record of the case at hand. The latter holding also avoids concern that a patent held valid may be held invalid on a different record in another case. When, however, a challenger has carried his burden of proof it would appear appropriate to hold the patent invalid, for a holding that the burden had been carried is synonymous with invalidity.

APPENDIX B
UNITED STATES DISTRICT COURT
CENTRAL DISTRICT OF CALIFORNIA

CASE NO. CV 76-917 MRP

ENVIRONMENTAL DESIGNS, LTD.,

Plaintiff,

v.

UNION OIL COMPANY OF CALIFORNIA and THE RALPH M.
PARSONS COMPANY,

Defendants.

UNION OIL COMPANY OF CALIFORNIA and THE RALPH M.
PARSONS COMPANY,

Counterclaim Plaintiffs,

v.

ENVIRONMENTAL DESIGNS. LTD. and TRENTHAM
CORPORATION,

Counterclaim Defendants.

FINDINGS OF FACT AND CONCLUSIONS OF LAW

This action was tried by the Court without a jury, and oral argument was presented at the conclusion of the trial, followed by the filing of post-trial briefs. The Court has also heard further oral argument on the issue of infringement. The Court having reviewed the facts, the law, and the arguments of the parties, now enters the following Findings of Fact and Conclusions of Law.

A. NATURE OF THE ACTION

1. On March 22, 1976, Environmental Designs, Ltd., a limited partnership ("Environmental Designs"), filed a complaint seeking a declaratory judgment that U.S. Patent No. 3,752,877 owned by the Ralph M. Parsons Company ("Parsons") is invalid. Union Oil Company of California ("Union Oil"), as licensing agent of Parsons for the process claimed by the patent, was joined with Parsons as co-defendant. On April 30, 1976, Union Oil and Parsons, as part of their answer to the complaint, counterclaimed for infringement of U.S. Patent No. 3,752,877.

2. Union Oil had, in 1974, called Patent No. 3,752,877 (referred to herein as the Beavon patent) to the attention of Environmental Designs as a result of advertising by the latter of a tail gas treating process called the Trencor H₂S Preferential Absorption Process (Trencor H₂S Process). In early 1975, it was announced that Trentham Corporation ("Trentham"), the sole general partner of Environmental Designs, would construct a tail gas treating plant utilizing the Trencor H₂S process at a refinery of Tenneco Oil Company at Chalmette, Louisiana.

3. After an exchange of correspondence, Union Oil, in a letter dated November 12, 1975, offered Environmental Designs a paid-up license entitling it to have practiced at the Chalmette refinery the process claimed in the Beavon patent. The offered license was based upon a formula which would have involved payment of an amount between \$13,000 and \$14,000. In response, Environmental Designs filed this action in March 1976.

4. On or about March 17, 1978, Trentham was, by leave of Court, joined as counterclaim defendant in the infringement counterclaim. (Except where separately identified, Environmental Designs and Trentham are referred to herein as "plaintiffs" and Union Oil and Parsons are referred to as "defendants.") On or about April 13, 1978, Trentham, as part of its answer to the infringement counterclaim, filed a "second Counterclaim Against Defendants (Union Oil and Parsons) for Violation of the Antitrust Laws".

B. THE SUBJECT MATTER OF THE BEAVON PATENT

5. The patent application which led to issuance of the Beavon patent was filed in the U.S. Patent Office on August 27, 1969. The Beavon patent issued on August 14, 1973, there having been filed, on March 19, 1971, a continuation-in-part application.

6. The Beavon patent is directed to a process ("Beavon process") for treatment of the effluent gases, called tail gases, from Claus plants to reduce the sulfur content in such gases. These tail gases include a number of chemical compounds. The sulfur compounds in the tail gas include hydrogen sulfide (H_2S), sulfur dioxide (SO_2), elemental sulfur (S), carbonyl sulfide (COS), and carbon disulfide (CS_2). These tail gases also include water (H_2O) in the vapor state and molecular hydrogen (H_2), as well as other compounds.

7. The overall purpose of the Beavon process is to reduce the sulfur content of Claus plant tail gas to a level low enough to be environmentally acceptable.

8. The Claus process is itself a process for removing sulfur compounds from gas streams. However, the practical limitations of the Claus process only permit recovery of about 97% of sulfur compounds. In view of the quantities of sulfur-containing gases which are processed, this means that, dependent upon the geographical region, large quantities of sulfur compounds would still be discharged daily into the atmosphere if sulfur removal were limited to the practice of the Claus process.

9. It is the 3% or more of sulfur compounds still remaining in tail gases from Claus plants to which the Beavon process is directed. In the Beavon process, sulfur dioxide and elemental sulfur in the tail gas are, by hydrogenation, catalytically converted to hydrogen sulfide; simultaneously, carbonyl sulfide and carbon disulfide are, by hydrolysis, catalytically converted to the same sulfur compound, hydrogen sulfide. The gas stream in which the above-described chemical conversions have simultaneously taken place is then treated to remove the sulfur which has

been converted to a single chemical form — hydrogen sulfide — instead of being in several different chemical forms. By the practice of the Beavon process, the difficult-to-remove last few percentages of sulfur values are prevented from entering the atmosphere and overall sulfur removal efficiencies, i.e., the total amount of sulfur values removed first by the Claus process and then by the Beavon process, of 99.5% or better have been attained.

10. Although the Beavon patent contains 12 claims, claim 1 may be taken as representatively describing the process in considering the issue of patent validity. It reads:

1. A continuous process for reducing the sulfur content of effluent gas streams containing water, sulfur dioxide, carbonyl sulfide and carbon disulfide which comprises the steps of:

(a)(i) enriching the effluent gas stream with a source of hydrogen to a level which is at least equal to the stoichiometric amount of hydrogen required to convert the contained sulfur dioxide to hydrogen sulfide and water and sulfur to hydrogen sulfide and

(ii) catalytically hydrogenating at least essentially all of the contained sulfur dioxide to hydrogen sulfide and water and sulfur to hydrogen sulfide and

(iii) simultaneously hydrolyzing carbonyl sulfide and carbon disulfide to hydrogen sulfide at a temperature from about 300 to about 800°F.,

(iv) whereby contained water and water formed in the hydrogenation of sulfur dioxide to hydrogen sulfide are utilized for the hydrolysis of carbonyl sulfide and carbon disulfide;

(b) cooling the hydrogenated gas stream to at least the dew point of water to condense water;

(c) separating condensed water from the hydrogenated gas stream; and

(d) treating the cooled hydrogenated gas stream to remove hydrogen sulfide.

11. The Beavon process solved the complex problems inherent in a multi-component chemical system — one in which sulfur was present in several chemical forms. Beavon's solution was the simultaneous catalytic conversion of these several forms to one chemical form — hydrogen sulfide. Sulfur dioxide is catalytically converted by hydrogenation to hydrogen sulfide; carbon disulfide and carbonyl sulfide are simultaneously catalytically converted by hydrolysis to hydrogen sulfide. Then, by the subsequent process steps, the offensive constituent, sulfur, is removed by the removal of the hydrogen sulfide, in which the sulfur is chemically bound.

C. THE CLAUS PROCESS

12. When emitted into the atmosphere, sulfur-containing compounds are pollutants. This is true whether the emitted compound is the relatively odorless compound, sulfur dioxide, or the highly offensive compound, hydrogen sulfide, or some other sulfur compound such as carbon disulfide or carbonyl sulfide.

13. Since the combustion of sulfur-containing fuels results in emissions into the atmosphere of sulfur compounds, various refining processes and treating processes have been developed to remove sulfur, i.e., desulfurize, fuel oils, gasoline, and natural gas. The removal of sulfur from the fuel, however, does not end the potential for sulfur pollution. The latter can be avoided only if the sulfur removed from fuels is itself disposed of in a manner which prevents its emission into the atmosphere.

14. The Claus process is a sulfur recovery process which, as a basic process, has been known for many years. In the Claus process, elemental sulfur is recovered as a solid in a process involving the basic reaction:



In words, the sulfur (S) present in the gaseous compounds, sulfur dioxide (SO_2) and hydrogen sulfide (H_2S), is by the practice of this process converted to elemental sulfur which is condensed and removed as a solid from the gas stream. Solid elemental sulfur is a valuable commodity which is used as a

fertilizer and as a raw material in the production of industrial chemicals.

15. The Claus process provided a means for reducing emission of sulfur-containing compounds into the atmosphere. Sulfur-containing waste gases from refinery desulfurization processes could be collected and further processed in Claus sulfur recovery plants. Sulfur-containing waste gases from treating processes for "sour" (sulfur-containing) natural gas could be similarly treated.

16. In the Claus process, the conversion of sulfur-containing compounds to elemental sulfur is not complete. In a two-stage Claus plant (one in which the reaction is successively conducted in two reactors with treatment between the stages to improve reaction conditions in the second reactor), the percentage conversion of sulfur compounds to elemental sulfur is about 92%. The addition of a third stage improves the overall conversion to about 97%.

17. The tail gas exiting from a Claus plant still contains sulfur-containing compounds including sulfur, unreacted sulfur dioxide, unreacted hydrogen sulfide, and carbonyl sulfide and carbon disulfide which are formed by side reactions that take place in the Claus reactor.

18. In the past, the tail gas from Claus plants, containing these several sulfur compounds, was incinerated and discharged into the atmosphere. Incineration did not reduce the amount of sulfur discharged into the atmosphere; it simply converted all of the sulfur compounds in the tail gas to sulfur dioxide — a compound of less toxicity than other sulfur compounds. Sulfur dioxide was also a pollutant and its discharge into the atmosphere in the quantities involved caused many complaints. But, prior to 1969, there was no effective control process which could reduce in amount the sulfur content of the Claus tail gas being discharged into the atmosphere.

19. The magnitude of the pollution problem that still remained on a national scale is illustrated by the situation which existed in Los Angeles County in 1966.

20. The first regulation in Los Angeles County limiting to 2000 ppm (0.2% by volume) the amount of sulfur dioxide which could be emitted was issued in 1948 by the Air Pollution Control District ("APCD") for Los Angeles County. But that regulation included a then necessary exclusion. The exclusion permitted so-called scavenger plants to discharge in excess of the 2000 ppm limit if the total sulfur dioxide emissions from the scavenger plant and the units served by it were less than the amount which would have been emitted without the scavenger plant in operation. The operation of Claus plants came within this exclusion.

21. The result of the regulation was that Claus plants were installed. By 1966, nine sulfur recovery plants, i.e., Claus plants, were operating in Los Angeles County. These plants were preventing emissions of 885 tons of sulfur dioxide per day. Nevertheless, even with that step forward, 115 tons of sulfur dioxide were still being emitted into the atmosphere daily, the major portion of which came from incineration of Claus tail gases from Claus plants concentrated in the small heavily-populated area, i.e., the South Bay area of Los Angeles County.

D. THE EARLIER FAILURES TO RECOGNIZE THE BEAVON SOLUTION

22. The need for a means for reducing sulfur dioxide emissions beyond the level achievable by Claus process treatment and incineration of the Claus tail gases was widely evident in Los Angeles County and elsewhere during the 1960's.

23. In Los Angeles County, numerous complaints were made to the APCD by the public regarding the continuing sulfur dioxide emissions. At this time, the APCD operated under a policy laid down by the Board of Supervisors and County Counsel that required the existence of "known technical means of accomplishing the desired results" before more stringent standards as to emissions would be adopted. In response to the

complaints, meetings were held with the companies involved in efforts to find a solution by which emissions could be reduced. No such solution emerged. In that period, 1965-1969, no control process was available which would reduce the sulfur emissions from Claus plants.

25. Parsons, a leader in the construction of Claus plants, also recognized the need. It recognized that, if no solution to the problem of sulfur dioxide was found, construction of such plants would be adversely affected. Parsons' president in 1966 requested that the Parsons engineering staff make a concerted effort to solve the problem. Contemporaneously, engineers at Parsons prepared an extensive report for a company in Alberta, Canada where large quantities of hydrogen sulfide-containing natural gas were produced. The report described in detail the results of a review of methods for reducing sulfur dioxide emissions from Claus plants. The solution later invented by Mr. Beavon was not even suggested in this report.

26. In January 1969 (some few months before the Beavon invention), the National Air Pollution Control Techniques Committee issued a comprehensive report entitled "Control Techniques for Sulfur Oxide Air Pollutants." The constituency of this committee was national in scope; its members represented a broad cross-section of industry. This report compiled the available information in the literature, as well as information received from committee members, industrial contributors, the staff of the federal agencies involved, and local control agencies across the country. It covered then-existing commercial processes for control of SO_2 emissions, as well as such processes which were in the development or research stage. In referring to sulfurous emissions from Claus plants, only incineration was listed in the report as the usual method of control and the recommended method of control.

27. Trentham's approach to the problem was summarized in a Resume of Trencor Research and Development Program which referred to the state of affairs in 1970. While the Resume made proposals for treatment of Claus tail gas, it contained no

reference whatsoever to the reduction of all sulfur compounds to hydrogen sulfide, the approach followed in the Beavon process.

28. There were serious obstacles to solving the problem because multi-component chemical systems involve considerable complexity. Where a number of chemical reactions take place simultaneously, each may be influenced by different variables and predictability is difficult. The Claus tail gas is a multi-component chemical system. In addition to hydrogen sulfide and sulfur dioxide, it contains carbonyl sulfide (COS) and carbon disulfide (CS₂), compounds which plaintiffs' expert, Dr. Hyne, described as "proven to be the two most intractable components of Claus tail-gas streams in desulfurization."

29. There was also skepticism as to a process for treating Claus tail gases which, even in part, involved conversion of the contained sulfur compounds to hydrogen sulfide. One of defendants' chemical experts, Dr. Dalla Lana, made a proposal in 1970 that all the contained sulfur compounds be converted to sulfur dioxide because he believed that conversion to hydrogen sulfide was the wrong direction to go. Plaintiffs' chemical expert, Dr. Hyne, in a technical article published before the first public announcement of the Beavon process, expressed his own skepticism in the following terms:

The main disadvantage of the direct reduction with hydrogen is that the reduction cannot be stopped at the zero oxidation state of sulphur — namely elemental sulphur — and significant amounts of the SO₂ are reduced even further to the —2 oxidation state, namely H₂S. One is therefore in the somewhat embarrassing position of having replaced one toxic component of the effluent gas, namely SO₂, with another toxic material, namely H₂S.

30. The three-pronged standard for factual inquiry into non-obviousness articulated in *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966), requires examination of (1) the scope and content of the prior art; (2) the differences between the prior art and the claims at issue; and (3) the level of ordinary skill in the pertinent art.

a) **The Scope and Content of the Prior Art**

31. The prior art included the reports, documents, and knowledge detailed in Section D, *supra*. It included also a number of patents and a technical article (Doumani — Industrial and Engineering Chemistry, April, 1944) which were cited by the Patent Office examiner during the prosecution of the patent applications leading to issuance of the Beavon patent. Further, the prior art included additional patents and publications upon which plaintiffs rely in support of their contention of the obviousness of the subject matter of the Beavon patent.

(i) *Prior Art Cited by the Patent Office*

32. The most pertinent prior art cited by the Patent Office examiner was Doumani (Patent No. 2,361,825), the contemporaneous Industrial and Engineering Chemistry article by the same Doumani, and Thumm (Australian Patent No. 223,904).

33. The Doumani patent issued in 1944. It stated that "(t)he reduction of sulphur dioxide with hydrogen has been known for many years," and included the statement, "With a ratio of hydrogen to sulphur dioxide of 3 or greater, all of the sulphur dioxide can be converted to hydrogen sulphide with but traces of free sulphur."

34. The Doumani patent described only a sulfur dioxide feed stream in which there were none of the other sulfur-containing constituents of a Claus tail gas; it made no reference to COS or CS₂. Further, there was absent from Doumani any indication that hydrogenation of sulfur dioxide and sulfur could or would proceed simultaneously with hydrolysis of carbonyl sulfide and carbon disulfide.

35. The Thumm patent described treating of a tail gas from a Claus plant — a gas described as containing SO₂, H₂S, CS₂, COS, and H₂O. The Claus tail gas was passed through a Claus reactor in which sulfur had previously been deposited on the catalyst in the reactor as a result of operating the Claus reactor at low temperature, i.e., "a cold bed Claus." The tail gas was at

a temperature high enough, i.e., above the dew point of sulfur, to vaporize the deposited sulfur, and the vaporized sulfur was carried out of the reactor by the gas stream.

36. Thumm also described an embodiment of his process in which steam was added to the tail gas before it entered the above-described reactor so that carbonyl sulfide and carbon disulfide were hydrolyzed over the catalyst in the reactor according to the following reactions:



Thumm described, therefore, the hydrolysis reactions for both carbonyl sulfide (COS) and carbon disulfide (CS₂). Thumm also stated that, within the Claus reactor, the Claus reaction between hydrogen sulfide (H₂S) and sulfur dioxide (SO₂) occurred simultaneously with the above-given hydrolysis reactions.

37. The Patent Office had before it separate pieces of prior art which described hydrogenation of SO₂ (Doumani patent; Doumani article), a Claus tail gas stream containing COS and CS₂ (Thumm); the equations for hydrolysis of COS and CS₂ (Thumm); and simultaneity of chemical reactions, specifically, the Claus reaction and the hydrolysis reactions for COS and CS₂ (Thumm). There was not, however, any prior art which made obvious or even suggested catalytically hydrogenating at least substantially all of the sulfur dioxide and sulfur to hydrogen sulfide, and simultaneously hydrolyzing carbonyl sulfide and carbon disulfide to hydrogen sulfide at a temperature from about 300 to about 800F. When all of the claims in the final application for patent had been amended to so define the invention, the Beavon patent issued.

(ii) *Prior Art Cited by Plaintiffs*

38. In its Notice Under 35 U.S.C. § 252 filed before trial, plaintiffs cited eleven foreign and U.S. patents and six technical articles and brochures in addition to the prior art patents and publications which had been cited by the Patent Office during

the prosecution of the Beavon applications. In the course of trial, plaintiffs emphasized only the following: the Doumani patent, *supra*; British Patent Nos. 952,555 and 1,018,630; Chapter 13 of the Kohl and Riesenfeld book, "Gas Purification"; and the Bacon and Boe article "Hydrogen Sulfide Production from Sulfur and Hydrocarbons."

39. The additional prior art materials relied upon by plaintiffs add nothing to the prior art teachings which were before the Patent Office examiner.

40. British Patent 952,555 describes hydrolysis of carbonyl sulfide. It states, too, that the so-called shift reaction, which is the conversion of carbon monoxide with water to form hydrogen and carbon dioxide, does under certain conditions take place simultaneously with the above-described carbonyl sulfide hydrolysis reaction. There is, however, neither sulfur dioxide nor sulfur in the feed stream of the '555 patent. There is no suggestion in that patent of the essentially complete hydrogenation of those compounds which is a requisite step in the Beavon process.

41. British Patent 1,018,630 also describes hydrolysis of carbonyl sulfide. The patent refers to "hydrogenation or hydrogenative decomposition of certain other impurities." The expert testimony as to the content of the patent itself and the expert testimony as to the partial oxidation unit described in the patent established that no sulfur dioxide would be present in the feed gas stream treated in British Patent 1,018,630. There is no suggestion in this patent of essentially complete hydrogenation of sulfur dioxide coupled with essentially complete hydrolysis of carbonyl sulfide and carbon disulfide.

42. The Bacon and Boe article was published in 1945 and describes a process for commercial production of hydrogen sulfide. The feed materials were methane and sulfur. Unlike the feed gas to the Beavon process, there was no sulfur dioxide, no hydrogen sulfide, no carbonyl sulfide, and no carbon disulfide present in the feed gas. At some point in the described single-step reaction, two reactions, one involving hydrolysis of carbon

disulfide and the other involving the reaction of methane and sulfur, proceeded simultaneously. However, the same article warns that sulfur dioxide was formed in the single-step reaction. The Beavon process converts all sulfur compounds, including sulfur dioxide, to hydrogen sulfide.

43. The Kohl and Riesenfeld book "Gas Purification" discusses a large number of purification processes. It generally describes hydrolysis of organic sulfur compounds; it states the basic reactions for hydrolysis of carbonyl sulfide and carbon disulfide; it describes some specific processes which involve hydrolysis of organic sulfides. But it goes no further as a teaching of the Beavon process. A passing reference to hydrogenation of sulfur dioxide is made in a chapter entitled "Dry Oxidation Processes"; the references to hydrolysis of carbonyl sulfide and carbon disulfide are in a separate chapter entitled "Catalytic Conversion of Gas Impurities."

b) The Differences between the Prior Art and the Claimed Beavon Process

44. Issued patents are entitled to a statutory presumption of validity, 35 U.S.C. § 282. In the case of the Beavon patent, the most relevant prior art was before the Patent Office examiner. The additional prior art cited by plaintiffs is merely cumulative. It does not disclose anything which was not found in the Doumani patent and in the Thumm patent. Plaintiffs have failed to rebut the presumption of validity.

45. The Doumani patent teaches the hydrogenation of sulfur dioxide to hydrogen sulfide. It made no reference, however, to either carbonyl sulfide or carbon disulfide. The Thumm patent described hydrolysis of carbonyl sulfide and carbon disulfide to hydrogen sulfide. It also described that the hydrolysis reactions took place in a Claus reactor simultaneously with the Claus reaction by which hydrogen sulfide and sulfur dioxide are reacted to form elemental sulfur. The product gas from the Thumm process was therefore a Claus-type tail gas.

46. While Thumm described simultaneous chemical reactions, including hydrolysis of carbonyl sulfide and carbon disulfide, the hydrogenation of sulfur dioxide to hydrogen sulfide was totally absent. The Doumani and Thumm prior art gave no suggestion that simultaneous catalytic hydrogenation and hydrolysis of contained sulfur compounds to a single form — hydrogen sulfide — would produce the successful results achieved by the Beavon process.

47. Although the reactions involved were separately known, the Beavon process involves simultaneous occurrence of a number of reactions, each of which could be influenced by different variables. The occurrence of a chemical reaction under one set of variables gives no assurance to whether or to what extent it will take place under a different set of variables. The results achieved by the Beavon process are therefore unusual and surprising.

c) The Level of Skill

48. Factual findings on the level of ordinary skill in the pertinent art can be made only by an analysis of the problem solved by the invention and the efforts of others to arrive at a satisfactory solution. *Photo Electronics Corporation v. England*, 581 F.2d 772, 781 (9th Cir. 1978).

49. In the period 1965-1969, many were working on the development of a process for reducing sulfur dioxide emissions. The 1966 Parsons report directed to reduction of SO₂ emissions included a summation of the Doumani patent and the Doumani technical article and, in addition, referenced the Kohl and Riesenfeld book. Yet, the availability of those prior art materials did not suggest to the Parsons engineers the Beavon solution. Engineers at Trentham studied the Doumani patent in 1966. Yet, even in 1972, the Trentham approaches to the problem did not contemplate the reduction of all sulfur compounds to hydrogen sulfide, the solution found by Mr. Beavon.

50. Both Dr. Dalla Lana, defendants' chemical expert, and Dr. Hyne, plaintiffs' chemical expert, have extensive backgrounds in sulfur chemistry. Both of these individuals, prior to learning of the Beavon invention, separately expressed views that reduction of sulfur compounds to hydrogen sulfide was not the way to solve the problem. The basic chemical reactions for hydrogenation of sulfur dioxide and sulfur to hydrogen sulfide were known. So, too, were the basic chemical reactions for hydrolysis of carbonyl sulfide and carbon disulfide. Mr. Beavon was the first to combine these reactions to provide a widely accepted process for control of sulfur dioxide emissions.

51. Plaintiffs have urged that the "Riesenfeld disclosure" is probative of the level of skill of the art. Fred Riesenfeld was a Parsons employee who in 1960 prepared an handwritten disclosure in which he described hydrogenation of sulfur dioxide and sulfur to hydrogen sulfide. He also referred to reducing carbonyl sulfide to hydrogen sulfide with an appropriate reducing agent such as hydrogen. Mr. Riesenfeld made no reference to carbon disulfide in his disclosure; further, he made no reference to hydrolysis reactions.

52. In 1961, Mr. Riesenfeld requested that Parsons make some computer calculations based upon his disclosure; he also inquired of two manufacturers as to possible catalysts. After 1961, Mr. Riesenfeld did nothing further with his disclosure. He was again reminded of it only when, in 1969, he saw an internal memorandum of Mr. Beavon, a co-worker of Mr. Riesenfeld, in which the Beavon process was described.

53. Although the Riesenfeld disclosure may be considered a "conception", it was not an invention. The facts surrounding the Riesenfeld disclosure establish that the subject matter of the disclosure was abandoned. It lay buried in a drawer from 1961 to 1969, spanning a period during which Parsons was actively seeking a solution to the problem of sulfur dioxide emissions.

54. Evidence that other persons worked under the same state of the prior art and independently arrived at the same solution as

that embodied in a patent claim has been held to provide evidence of obviousness, even though the other solutions were not prior art. *Ceco Corp v. Bliss & Laughlin Industries, Inc.*, 557 F.2d 687, 690 (9th Cir. 1977); *Servo Corporation of America v. General Electric Company*, 337 F.2d 716, 720 (4th Cir. 1964). Evidence of "independent conception" has been treated as a sub-test of obviousness in the same sense as commercial success has been treated as a sub-test of nonobviousness. *Reeves Brothers, Inc. v. U.S. Laminating Corp.*, 417 F.2d 869, 872 (2nd Cir. 1969).

55. The Court has given consideration to the Riesenfeld disclosure in the context of a sub-test on the issue of obviousness. The Court's conclusion of nonobviousness is not affected by the evidence with respect to the Riesenfeld "conception". The foregoing applies with equal force to Shell British Patent No. 1,332,337 upon which plaintiffs also appear to rely as an "independent conception."

56. In sum, the Beavon process satisfied a long felt but unfilled need. It was one of the processes which enabled Los Angeles County to adopt more stringent regulations for controlling sulfur dioxide emissions to the atmosphere. The Beavon process has met with substantial commercial success. A large percentage of the Claus tail gas treating plants in the United States are based upon the Beavon process. In recognition of the achievements of the Beavon process, various individual engineering awards have been presented to Mr. Beavon, and Parsons has received a project award.

F. THE ISSUE OF FRAUD ON THE PATENT OFFICE

57. Plaintiffs charged defendants with fraud and inequitable conduct on the prosecution of the Beavon patent before the Patent Office. They rely upon a number of alleged acts and omissions as constituting the alleged fraud and inequitable conduct — (i) failure to submit the Riesenfeld disclosure and certain portions of the Kohl and Riesenfeld book to the Patent Office; (ii) failure to perform and submit to the Patent Office

certain computer calculations while performing and submitting to the Patent Office certain other computer calculations; (iii) alleged misstatements as to the content of the Doumani patent; (iv) use of computer calculations as examples in the Beavon patent.

58. Subjective culpability is required for a finding of fraud on the United States Patent Office. There must be some element of wrongfulness, wilfulness or bad faith. *Carpet Seaming Tape Licensing Corporation v. Best Seam Incorporated*, 616 F.2d 1133, 1138 (9th Cir. 1980). The presence of this mental element must be proven by clear and convincing evidence. *Carpet Seaming* at 1139. The applicant for a patent is accorded the right to exercise good faith judgment in deciding what matters are and are not of sufficient relevance and materiality to require disclosure. *Xerox Corp. v. Dennison Mfg. Co.*, 322 F. Supp. 963, 968-969 (S.D.N.Y. 1971).

59. Plaintiffs did not establish by clear and convincing evidence that as to any of the alleged acts and omissions, there was any subjective culpability on the part of defendants. In fact, the evidence established that defendants exercised good faith judgment in a difficult area of practice which requires application of principles of law in conjunction with an understanding of highly technical subject matter. Further, there was no evidence that any alleged act or omission misled the Patent Office examiner into allowing a claim.

60. As to the Riesenfeld disclosure, plaintiffs conceded that that disclosure was not prior art. It was advanced as probative only of the level of skill. Under the current rules of the Patent Office, which impose no less a standard of disclosure than the ones which existed in 1970-1973, no duty is imposed for "disclosure of information concerning the level of skill for purposes of determining obviousness." The failure to submit the Riesenfeld disclosure to the Patent Office does not constitute fraud or inequitable conduct.

61. There was neither fraud nor inequitable conduct in the prosecution before the U.S. Patent Office of the Beavon patent.

G. THE INFRINGEMENT ISSUE

62. Defendants have counterclaimed for infringement of nine claims (1-8 and 12) of the Beavon patent. None of the differences between these nine claims is material to the determination of the infringement issue. Accordingly, claim 1 is the only one of these nine claims which is discussed in these Findings.

63. The preamble of claim 1 of the Beavon patent, read in light of the specification, reveals that the overall purpose of the process of claim 1 is to reduce the sulfur content of Claus plant tail gas to a level low enough to be environmentally acceptable.

64. The body of claim 1 consists of clauses (a) through (d) that recite four steps to take to accomplish the overall purpose of the process of claim 1. The disclosure of the Beavon patent sets forth the principles involved in these recited steps, the functions they perform, the way they work, and the intermediate and overall results they produce.

65. Read in light of the specification, claim 1 embraces a tail gas clean-up process, the heart of which is set out in clause (a): the simultaneous catalytic hydrogenation and hydrolysis step. Because this step is carried out first, essentially all of the sulfur in the gas stream that undergoes subsequent processing in the remaining steps is in the form of hydrogen sulfide. Thus, the remaining steps are applied to a gas stream with little or none of the intractable sulfur compounds carbonyl sulfide and carbon disulfide, and with little or none of the sulfur compound sulfur dioxide which is a reactant in the formation of corrosive polythionic acids. The gas stream that emerges from the catalytic reaction zone is not amenable to immediate treatment to remove hydrogen sulfide. The reaction zone is maintained at temperatures in the range from about 300° to 800°F, and accordingly the emerging gas stream is hot. Further, the gas stream at that point contains a substantial amount of water in vapor phase. A

principle of the Beavon invention pointed out in claim 1 is to cool the gas stream to cause water to change from vapor phase to liquid phase and separate liquid water before treating the cooled gas stream to remove hydrogen sulfide.

66. The disclosure makes it clear that the Beavon invention can be carried out not solely by following the practice described as "preferred" but alternatively by following practices that are convenient alternatives and substantively the same.

67. Other patent documents including the prior art and the file history of the Beavon patent explain the scope of the invention set forth in claim 1. These documents reveal the intentions that both Mr. Beavon and the Patent Office examiner manifested with respect to claim 1.

68. What became patent claim 1 was presented to the Patent Office examiner as claim 22 of Mr. Beavon's CIP application; its language resulted from an interview. The file history contains the following record of what was agreed to during that interview:

Claim 22 requires, as was agreed to be one clear point of distinction, namely that hydrogenation and hydrolysis occur simultaneously in one catalytic reaction zone, at the temperatures specified, in combination with the steps of cooling the gas stream to at least the dew point of water to condense water and separating condensed water from the hydrogenated stream and finally treating the hydrogenated stream to remove hydrogen sulfide. (PX 3, p. 93; emphasis added.)

69. On the same page of the file history, it is noted that other claims, which include the claim that became patent claim 11, set forth the manner in which hydrogen sulfide is removed from the gas stream. Patent claim 11 specifies that "formed water and water present in the hydrogenated gas stream are condensed prior to contact with the absorption solution."

70. The defendants' counterclaim for infringement is directed to a process plaintiffs call "The Trencor H₂S Preferential Absorption Process ("Trencor H₂S process").

71. The Trencor H_2S process is a tail gas treating process. It has been practiced in a tail gas treating plant built by Trentham for Tenneco Oil Company ("Tenneco") at Tenneco's refinery in Chalmette, Louisiana. Environmental granted Tenneco a license to use technical information relating to this process. Both Trentham and Environmental induced Tenneco to use the Trencor H_2S process.

72. Tenneco has a Claus plant at its Chalmette refinery. The effluent gas stream from that Claus plant contains water, sulfur, sulfur dioxide, carbonyl sulfide, and carbon disulfide. The purpose for using the Trencor H_2S process at the Chalmette refinery is to reduce the sulfur content of that effluent gas stream to yield a treated gas stream. When the treated gas stream is vented to the atmosphere, its sulfur content is low enough to be environmentally acceptable. The overall purpose of the Trencor H_2S process is identical to the overall purpose of the Beavon invention as recited in the preamble of claim 1 of the Beavon patent.

73. The Trencor H_2S process comprises four steps. These steps are: first, a hydrogenation step; second, a cooling step; third, a water separating step; and fourth, a hydrogen sulfide removing step.

74. As a result of the hydrogenation step, essentially all of the sulfur content of the gas stream undergoing treatment is in the form of hydrogen sulfide. To carry out this first step, hydrogen is added to the effluent gas stream exiting the Claus plant. The resulting hydrogen-enriched gas stream enters a catalytic reactor in which the temperature is in the range from about $300^{\circ}F$ to $800^{\circ}F$. In the reactor, simultaneous reactions occur. Elemental sulfur and sulfur dioxide each enter into a hydrogenation reaction with hydrogen to produce hydrogen sulfide and water. Simultaneously, carbonyl sulfide and carbon disulfide each enter into a hydrolysis reaction with water to produce hydrogen sulfide. The gas stream emerging from the

reactor is called the hydrogenated gas stream. The water it contains is in vapor form because the hydrogenated gas stream temperature exceeds the dew point of water.

75. The recitations of clause (a) of claim 1 of the Beavon patent apply literally and substantively to the above-described hydrogenation step of the Trencor H_2S process.

76. The purpose and effect of the cooling step of the Trencor H_2S process is to cool the hydrogenated gas stream to a temperature low enough to cause the water to change phase from a vapor to a liquid. This temperature is below the dew point of water. Comparing this to the corresponding step of the Beavon invention as set out in clause (b) of claim 1, the purpose and effect of the two corresponding steps are identical.

77. At trial, two words were used to describe the physical way in which water undergoes a change of phase from vapor to liquid. One was "condensation"; the other was "absorption."

78. At trial, plaintiffs' expert testified that the word "absorption," not the word "condensation," describes the way the water changes phase in the Trencor H_2S process. Mr. Beavon testified, "any chemical engineer that I know of in ordinary practice would consider it condensation." In short, the trial testimony is in conflict whether the word "condensation" literally applies to the change of phase water undergoes in the Trencor H_2S process. Irrespective of which of the two words literally applies, findings are required on the issue of whether the clauses of claim 1 substantively apply to the corresponding steps of the Trencor H_2S process. Findings Nos. 79-91 are directed to that issue.

79. In the Trencor H_2S process, the cooling step is carried out in two stages. The first-stage cooling occurs in a waste heat boiler that is located between the reactor and a booster blower. The waste heat boiler is a heat exchanger in which the hydrogenated gas stream flows adjacent to, but not in direct contact with, another stream. As a result, the hydrogenated gas stream is somewhat cooled, and steam is generated. Having been somewhat cooled in the waste heat boiler, the hydrogenated gas

stream is pushed by the booster blower into equipment called an "absorber," where it comes into direct contact with a liquid and undergoes the second-stage cooling.

80. In the preferred practice disclosed in the Beavon patent, the cooling step is likewise carried out in two stages. The first-stage cooling occurs in a tail gas cooler. The tail gas cooler is identical in all respects to the waste heat boiler used in the Trencor H_2S process. Both perform the identical heat exchanging function by having the hydrogenated gas stream flow adjacent to, but not in contact with, another stream that receives heat to generate steam. Having been somewhat cooled in the tail gas cooler, the hydrogenated gas stream enters a contact condenser. In the contact condenser, the hydrogenated gas stream comes into direct contact with a liquid and undergoes the second-stage cooling.

81. The process steps in the Trencor H_2S process and that in the preferred practice disclosed in the Beavon patent are identical. They have the same overall purpose and effect. Furthermore, the cooling step of the Trencor H_2S process, like the cooling step disclosed in the Beavon patent, involves a first-stage cooling with a heat exchanging relationship rather than a direct contacting of the hydrogenated gas stream with a liquid, and then second-stage cooling with the hydrogenated gas stream directly contacting a liquid. However, the composition of the liquid used in the absorber to effect the second-stage cooling in the Trencor H_2S process is not identical to the nature of the liquid used in the contact condenser to effect the second-stage cooling disclosed in the Beavon patent.

82. The absorber in the Trencor H_2S process is a tower that includes two zones, viz, a quenching zone in the lower part of the tower and an absorbing zone in the upper part.

83. The somewhat cooled hydrogenated gas stream enters the tower at its bottom and flows upwardly. During its upward flow, the gas stream is subjected to these steps: the completion of the cooling step; the water separating step; and the hydrogen

sulfide removing step. The completion of the cooling step and the water separating step occur in the quenching zone. The hydrogen sulfide removing step occurs in the absorbing zone.

84. These steps occur because the gas stream flows through a downwardly flowing liquid containing an amine, viz, methyl diethanolamine ("MDEA"). At the top of the tower, where the MDEA solution enters the tower, the MDEA solution is lean. That is, its capacity to absorb hydrogen sulfide is at its maximum.

85. While the MDEA solution flows down through the absorbing zone, it removes hydrogen sulfide from the gas stream it contacts. As it progressively absorbs hydrogen sulfide, its capacity to further absorb hydrogen sulfide progressively decreases. By the time it leaves the absorbing zone, the MDEA solution has become loaded with absorbed hydrogen sulfide.

86. The loaded MDEA solution flows into the quenching zone and merges with a recirculating MDEA solution. This MDEA solution recirculates at a high volumetric flow rate to remove heat from and cool the gas stream it contacts to below the dew point of water. As a result, water vapor in the gas stream changes phase to liquid water, separates from the gas stream, and enters the recirculating MDEA solution. The loaded MDEA solution that emerges from the bottom carries with it not only the amount of water that entered the absorber as part of the lean MDEA solution, but also the amount of water that separated from the cooled hydrogenated gas stream. The above-described cooling and water separating steps are performed by using a liquid (loaded MDEA) that is heated by the gas stream it cools. Consequently, it does not treat the gas stream to remove hydrogen sulfide. Rather, desorption occurs resulting in addition of hydrogen sulfide to the gas stream.

87. After the hydrogenated gas stream has been subjected both to the second-stage cooling that completes the cooling step and to the water separating step, it is then subjected to the

hydrogen sulfide removing step. The MDEA solution in the absorbing zone is used to carry out this removing step.

88. The recitations of clause (d) of claim 1 of the Beavon patent apply literally and substantively to the above-described hydrogen sulfide removing step of the Trencor H_2S process. The use of the treating MDEA solution to remove the hydrogen sulfide is in accordance with the principles taught in the Beavon patent as indicated by the statement therein (column 4, lines 73-75) that an amine absorption system is a "convenient alternative." The sequence of performing the hydrogen sulfide removing step after the water separating step is also in accordance with the preferred practice disclosed in the Beavon patent. Because the water separating step occurs in the quenching zone before the hydrogenated gas stream has risen into the absorbing zone, there is no dilution of the treating MDEA solution that performs the function of removing hydrogen sulfide.

89. The liquid which is diluted as a result of the cooling and water separating steps in the Trencor H_2S process is the loaded MDEA solution in the quenching zone. The corresponding liquid disclosed in the Beavon patent is a condensate circulating through the contact condenser. This condensate is used to perform the functions of liquefying and separating water from the hydrogenated gas stream before the function of treating to remove hydrogen sulfide is performed. An advantage of doing this is set out in the Beavon patent at column 5, lines 12-13, as follows, "dilution of a *treating* absorption solution or like due to the presence of condensable water is precluded." The same advantage inheres in using the loaded MDEA solution to perform the same functions. The loaded MDEA solution is not a *treating* absorption solution. Only the MDEA solution in the absorbing zone is a treating absorption solution.

90. In the preferred practice disclosed in the Beavon patent, the condensate includes a neutralizer to provide a safeguard against the possibility of an undesired happening upstream in which some sulfur dioxide remains in the hydrogenated gas stream. One of plaintiffs' engineering documents describes soda

ash injection points. One point of injection is into the quenching zone. The injection of soda ash provides the same safeguard in the Trencor H_2S process that the neutralizer provides in the preferred practice disclosed in the Beavon patent.

91. The condensate and the loaded MDEA solution are both liquid, although not identical in composition. Both perform the same functions of liquefying and separating water from the hydrogenated gas stream before the function of treating to remove hydrogen sulfide is preformed. The MDEA solution, when lean, has a quality the condensate lacks, i.e., the ability to absorb a substantial amount of hydrogen sulfide. That difference in quality between the condensate and the lean MDEA solution does not exist between the condensate and the loaded MDEA solution. This is so because the loaded MDEA solution has been formed by combining the lean MDEA solution with the removed hydrogen sulfide.

92. In the way these two ingredients are used in the respective equipment, i.e., the contact condenser and the quenching zone, the loaded MDEA is a substitute for the condensate. The two are interchangeable. Exhibits CL and EV show that Trentham offered to build plants to carry out this process in which a contact condenser would be used. In short, the condensate and the loaded MDEA are equivalents as used in this process. Likewise, the quenching zone and the absorbing zone in the single absorbing tower are the equivalent of the two units, a contact condenser and an absorption system, that are disclosed in the Beavon patent.

93. The recitations of clauses (b) and (c) of claim 1 the Beavon patent apply substantively to the cooling and water separating steps of the Trencor H_2S process. The overall purpose of the Trencor H_2S process is identical to the overall purpose of the Beavon invention as recited in the preamble of claim 1. The recitations of clauses (a) and (d) of claim 1 apply literally and substantively to the hydrogenation and hydrogen sulfide removing steps, respectively, of the Trencor H_2S process. Thus, every clause of claim 1 applies substantively to a corresponding step of

the Trencor H_2S process. As a whole, the patented process and the Trencor H_2S process involve the same principles; they use the same steps; they perform these steps in the same sequential order; and they produce the same result.

94. In resolving the literal infringement issue, the Court considered the question of whether the word "condensation" applies to the change of phase the water undergoes in the quenching zone in the Trencor H_2S process. In Exhibit AL, a document in which plaintiffs described the construction and operation of the quenching zone, they said, "In quenching the hot gas a considerable amount of water will be *condensed*." In an answer given in an interrogatory (No. 22) during discovery, plaintiffs affirmed "*condensed* water [will] be removed from the gas stream." Mr. Trentham gave deposition testimony in which he testified, "Well, water is first stripped from the solution at the inlet to the quench tower and then *condensation* occurs." A vice president of Trentham who serves as a process and project manager, viz, Mr. Baumann, likewise testified that *condensation* occurs in the quench tower. Plaintiffs' contention that the word "condensation" does not apply rests solely on the trial testimony of their expert who understands the phrase "condensed water" to be limited to liquid phase consisting of water and only water. The meaning of the word "condensation" conveyed by the Beavon patent is not so limited. Instead, it applies to liquid phase water in a condensate that includes small amounts of hydrogen sulfide and other chemicals. Mr. Beavon testified that any chemical engineer would consider the way the water changes phase in the Trencor H_2S process to be condensation. The Court finds that the preponderance of the evidence is persuasive that the word "condensation" applies. Thus, clauses (b) and (c) of claim 1 apply literally, as well as substantively, to the cooling and water separating steps of the Trencor H_2S process.

H. THE ANTITRUST COUNTERCLAIM

95. Approximately two years after Environmental initiated this litigation, Trentham filed a pleading containing allegations

that are collectively referred to herein as the "antitrust counterclaim." Under the theory advanced by Trentham, it was required to prove that the patent was fraudulently procured (a so-called "Walker Process claim" under *Walker Process Equip. v. Food Mach. Chem. Corp.*, 382 U.S. 172, 177 [1965]) or known by the defendants to be invalid.

96. A clear and convincing standard of proof applies to a Walker Process claim. *Cataphote Corporation v. De Soto Chemical Coatings, Inc.*, 450 F.2d 769, 772 (9th Cir. 1971).

97. The same standard of proof applies to a claim based on bad faith infringement suits. *Hangards, Inc. v. Ethicon*, 601 F.2d 986, 996 (9th Cir. 1979), sets forth this rule and notes, "a patentee's infringement suit is presumptively in good faith and that this presumption can be overcome only by clear and convincing evidence."

98. Trentham filed to establish either that the Beavon patent was fraudulently procured or that defendants knew or should have known the patent was invalid. This failure of proof is a sufficient basis for dismissing Trentham's antitrust counterclaim.

99. Further, with respect to the alleged violation of Section 1 of the Sherman Act, 15 U.S.C. § 1, Trentham failed to show the existence of any contract, combination, or conspiracy in restraint of trade. The evidence at trial revealed only a lawful business arrangement under which defendant Union acts as the principal licensing agent for negotiating licenses authorizing use of the Beavon process, and under which the defendants share royalties received from licenses.

100. Section 2 of the Sherman Act, 15 U.S.C. § 2, prohibits monopolization, and attempts and conspiracies to monopolize. When Section 2 is applied to allegations of the type Trentham has made, the claims of an illegal patent "in and of themselves, must provide the monopoly power proscribed by Section 2 . . ." *Abbott Laboratories, Inc. v. Curtis Laboratories*, 597 F.2d 1312, 1314 (9th Cir. 1979). As to Trentham's allegations of attempt and conspiracy to monopolize, Trentham had the

burden to establish "(1) specific intent to control prices or destroy competition which respect to a part of commerce; (2) predatory or anticompetitive conduct directed to accomplishing the unlawful purpose; and (3) a dangerous probability of success." *Carpet Seaming Tape Licensing v. Best Seam Incorporated*, 616 F.2d 1133, 1141 (9th Cir. 1980).

101. Trentham failed to show that defendants, individually or jointly, had a specific intent to control prices or destroy competition. In licensing of the Beavon process, defendants have followed a basic approach of offering nonexclusive licenses to interested parties under terms that are nondiscriminatory. The reasonableness of the license fee belies any intent to control prices and is further confirmation of what was separately established by other evidence, namely, the claims of the Beavon patent do not place in defendants the power to control prices of, or exclude competition from, Claus plant tail gas treating processes. The Beavon process has competed and continues to compete in the marketplace with alternative processes.

102. An antitrust injury is an injury that "flows" from an antitrust violation. "To 'flow' from the wrong, . . . the loss must be 'the type of loss that the claimed violations would be likely to cause.'" *Handgards, supra*, at 997. Trentham failed to prove it sustained any such antitrust injury. Trentham offered only its expenses in this litigation as its proof of damages. The litigation, however, was initiated by Environmental (in which Trentham is the sole general partner) and that action was taken at a time when no decision had been made by defendants regarding litigation against either Environmental or Trentham. Trentham's assertions of claimed "injury," e.g., that the litigation was required to protect an investment in development work, were not supported by evidence establishing either that the "injury" had occurred or a connection between the claimed "injury" and the existence of the Beavon patent.

I. DAMAGES FOR INFRINGEMENT

103. Defendants had an established royalty rate for the granting of non-exclusive licenses under the Beavon patent to interested parties. The royalty rate was calculated on a formula which, when applied to the facts of this case, works out to \$14,000. A license at that rate was in fact offered to plaintiff by defendants.

104. Any Conclusion of Law deemed to be a Finding of Fact is hereby incorporated into these Findings of Fact.

CONCLUSIONS OF LAW

1. Any Finding of Fact deemed to be a Conclusion of Law is incorporated into these Conclusions of Law.

2. The Court has jurisdiction over this action under 28 U.S.C. § 1338.

3. Parsons is the owner of the entire right, title, and interest in and to the Beavon patent and has the right to maintain a counterclaim for infringement.

4. Under 35 U.S.C. § 282, the Beavon patent is entitled to a presumption of validity. The additional prior art that has been cited by plaintiffs does not weaken or destroy the presumption of validity. It is merely cumulative to prior art cited to the U.S. Patent Office. *Sante Fe-Pomeroy, Inc. v. P & Z Company, Inc.*, 569 F.2d 1084, 1092 (9th Cir. 1978).

5. The subject matter of the Beavon patent was nonobvious and meets all the conditions for patentability under 35 U.S.C. § 103.

6. During the prosecution of the Beavon applications which led to issuance by the U.S. Patent Office of the Beavon patent, there was neither fraud nor inequitable conduct which adversely affects the validity or enforceability of the Beavon patent.

7. The Beavon patent is valid and enforceable.

8. Any person who actively induces direct infringement of a patent is liable as an infringer, 35 U.S.C. § 271(b). It is an act of

direct infringement to use a patented invention within the United States during the patent term, without the patentee's consent, 35 U.S.C. § 271(a). The "patented invention" is defined by the claim or claims of the patent.

9. There are two main steps in the analysis of whether a claim has been infringed. The first involves an examination of the relationship between the claim and the teachings which the patentee has addressed to those skilled in the art. In this examination, the claim language is construed in light of relevant patent documents to determine the scope of the invention the patentee has pointed out in the claims. The second involves an examination of the relationship between the claimed invention and the product or process that stands accused of infringement. If that product or process is within the scope of the claimed invention, infringement exists; otherwise it does not.

10. A finding that the claim applies both literally and substantively to the accused product process necessitates a determination that the claim has been infringed. *Graver Tank Co. v. Linde Air Prod. Co.*, 339 U.S. 605, 607-609 (1950). Alternatively, a finding that the claim applies substantively, although not literally, to the accused product or process requires a determination that the claim has been infringed, so long as there is no file wrapper estoppel that precludes such a determination of infringement. *Union Oil Co. of California v. American Bitumuls Co.*, 109 F.2d 140, 144-146 (9th Cir. 1940).

11. The parties have advanced contrary contentions as to what claim 1 means, particularly with respect to two matters. One matter concerns the word "condensation" and its cognates which appear in the claim; the other matter concerns the phrase "prior to contact" which does not appear in the claim.

12. The preponderance of the evidence establishes that the word "condensation" literally applies to the change of phase water undergoes in the Trencor H₂S process within the quenching zone. Furthermore, the purpose and effect of liquefying water in the Trencor H₂S process are identical to the purpose

and effect of liquefying water in accordance with claim 1. Substantially the same means is used for the identical purpose to bring about the identical effect.

13. The phrase "prior to contact" appears in a dependent claim, viz, claim 11, not included within the counterclaim for infringement. The expression of this limitation in the dependent claim but not in the independent claim supports the conclusion that the independent claim has a broader scope.

14. Reading claim 1 more broadly than dependent claim 11 does not enlarge the scope of the patent beyond the actual invention Mr. Beavon taught therein. The actual invention embraces convenient alternatives that are substantively the same; it is not limited to the preferred practice disclosed in the specification. In that preferred practice, the cooling and water separating steps occur in a contact condenser by contacting the gas stream with a cooling liquid identified as a condensate. No absorption solution, lean or loaded, is part of that condensate. However, the actual invention is not limited to using a cooling liquid that does not include an absorption solution. To the contrary, the use of loaded MDEA solution for the same purpose and to the same effect, viz, cooling the gas stream and separating liquefied water before treating to remove hydrogen sulfide, is within the scope of the actual invention. Likewise, replacing the contact condenser and absorption system with an absorption tower having two functionally separate zones for sequentially quenching and then absorbing is within the scope of the actual invention. *No Joint Concrete Pipe Co. v. Hanson*, 344 F.2d 13, 15 (9th Cir. 1965).

15. The doctrine of file wrapper estoppel does not prevent a determination that the Trencor H₂S process is within the scope of claim 1. The gravamen of that doctrine "is that an applicant who acquiesces in the rejection of his claim, and accordingly modifies it to secure its allowance, will not subsequently be allowed to expand his claim by interpretation to include the principles originally rejected or their equivalents." *International Manufacturing Co. v. Landon, Inc.*, 336 F.2d 723, 727 (9th Cir. 1964).

16. Neither claim 1 nor any of the independent claims presented to the examiner was ever modified to express the phrase "prior to contact." None of these claims was ever modified to include that phrase by necessary implication. The extent of the necessary implication of the relevant modifications, which involved the cooling and water separating steps, was that the claim required the water separating step to precede the final step of treating to remove hydrogen sulfide. The Trencor H_2S process requires that. The determination that claim 1 embraces the Trencor H_2S process does not expand the claim to include any principles originally rejected or their equivalents.

17. Further, the modifications to the cooling and water separating steps did not secure the allowance of any claim. Instead, the application was allowed as a result of the redefinition of the first step of the claim to require simultaneous catalytic hydrogenation and hydrolysis. The Trencor H_2S process requires that. In summary, the Trencor H_2S process in every substantive respect comes within the scope of claim 1. The practice of the Trencor H_2S Process infringes the Beavon patent.

18. The defendants' and counterclaim plaintiffs' established royalty rate is the proper measure of damages to be awarded to them on account of counterclaim defendants' infringement of the Beavon patent. *United States National Bank v. Fabri-Valve Company*, 235 F.2d 565, 568 (9th Cir. 1956).

DATED: August 18, 1982

/s/ MARIANA R. PFAELZER
Mariana R. Pfaelzer
United States District
Judge

APPENDIX C
UNITED STATES DISTRICT COURT
CENTRAL DISTRICT OF CALIFORNIA

Case No. CV 76-917 MRP

ENVIRONMENTAL DESIGNS, LTD.,

Plaintiff,

v.

UNION OIL COMPANY OF CALIFORNIA and
THE RALPH M. PARSONS COMPANY,

Defendants.

UNION OIL COMPANY OF CALIFORNIA and
THE RALPH M. PARSONS COMPANY,

Counterclaim Plaintiffs,

v.

ENVIRONMENTAL DESIGNS. LTD. and
TRENTHAM CORPORATION,

Counterclaim Defendants.

This action having come on for trial before the Honorable Mariana R. Pfaelzer, United States District Judge presiding, the issues having been duly tried and Findings of Fact and Conclusions of Law having been entered,

IT IS ORDERED AND ADJUDGED,

1. The Findings of Fact and Conclusions of Law entered in this action are adopted for the purposes of, and are hereby made a part of, this Final Judgment, and the permanent injunction herein granted is issued on the basis of said Findings and Conclusions.

2. This Court has jurisdiction over the subject matter hereof and the parties hereto.

3. The claims of U.S. Patent No. 3,752,877 are valid and enforceable.

4. Counterclaim defendants Environmental Designs, Ltd. and Trentham Corporation have each infringed, and have each actively induced infringement of, claims 1 through 8 and 12 of U.S. Patent No. 3,752,877.

5. Plaintiff (and counterclaim defendant) Environmental Designs, Ltd.'s complaint for declaration of invalidity and non-infringement of U.S. Patent No. 3,752,877 is dismissed.

6. The separate counterclaim of Trentham Corporation for alleged antitrust violations is dismissed.

7. Counterclaim defendants Environmental Designs, Ltd. and Trentham Corporation, their officers, agents, servants, employees, and those persons, companies, or corporations in active concert or in participation with either of them, and each of them, are hereby permanently enjoined from infringing the claims of U.S. Patent No. 3,752,877.

8. Defendants and counterclaim plaintiffs The Ralph M. Parsons Company and Union Oil Company of California are, based upon their proofs of an established royalty as the fee for a non-exclusive paid-up license, jointly awarded damages in the amount of \$14,000 for the infringing acts of counterclaim defendants Environmental Designs, Ltd. and Trentham Corporation, said counterclaim defendants to be jointly and severally liable for said damages.

9. Defendants and counterclaim plaintiffs The Ralph M. Parsons Company and Union Oil Company of California are jointly awarded their costs in this action, Environmental Designs, Ltd. and Trentham Corporation to be jointly and severally liable for said costs.

DATED: August 18, 1982

/s/ MARIANA R. PFAELZER

Mariana R. Pfaelzer
United States District Judge

APPENDIX D
UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

No. 83-554

ENVIRONMENTAL DESIGNS, LTD., AND THE TRENTHAM CORP.,
Appellants,

v.

UNION OIL COMPANY OF CALIFORNIA AND RALPH M.
PARSONS, CO.,
Appellees.

ORDER

A petition for rehearing having been filed in this case,
UPON CONSIDERATION THEREOF, it is Ordered by the
court that the petition for rehearing be, and the same is hereby,
Denied.

FOR THE COURT:

/s/ GEORGE E. HUTCHINSON
CLERK

September 21, 1983

Date

cc: Andrew J. Belansky
B. R. Pravel

APPENDIX E-1

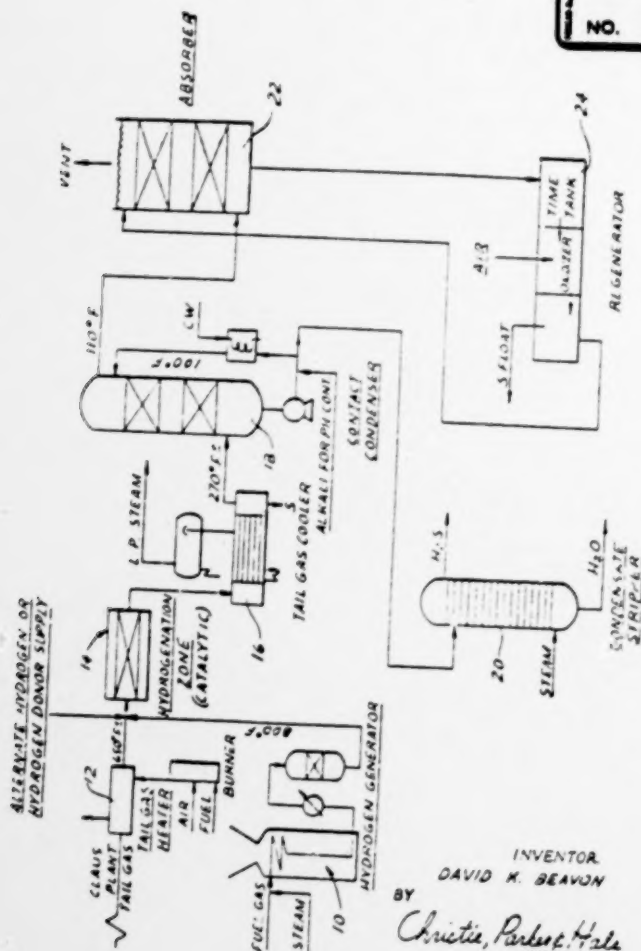
D. K. BEAVON

3,752,877

RECOVERY OF SULFUR COMPOUNDS FROM TAIL GASES

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NO. 1



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APPENDIX E-2

EXCERPT FROM U.S. PATENT NO. 3,752,877

Col. 5, Lines 6-16

The step of cooling the hydrogenated gas stream to at least the dew point of water and removing the water condensed is important to hydrogen sulfide extraction. First of all, the gas stream may be reduced to a temperature desirable for extraction of absorption of formed hydrogen sulfide. Since the cooled stream will be in some equilibrium with its contained water, dilution of a treating absorption solution or like due to the presence of condensable water is precluded. In addition, any trace amounts of sulfur dioxide which would react with and consume valuable treating chemicals is eliminated.

APPENDIX E-3

CLAIM 1 OF U.S. PATENT NO. 3,752,877

1. A continuous process for reducing the sulfur content of effluent gas streams containing water, sulfur dioxide, carbonyl sulfide and carbon disulfide which comprises the steps of:

- (a) enriching the effluent gas stream with a source of hydrogen to a level which is at least equal to the stoichiometric amount of hydrogen required to convert the contained sulfur dioxide to hydrogen sulfide and water and sulfur to hydrogen sulfide and catalytically hydrogenating at least essentially all of the contained sulfur dioxide to hydrogen sulfide and water and sulfur to hydrogen sulfide and simultaneously hydrolyzing carbonyl sulfide and carbon disulfide to hydrogen sulfide at a temperature from about 300 to about 800°F., whereby contained water and water formed in the hydrogenation of sulfur dioxide to hydrogen sulfide are utilized for the hydrolysis of carbonyl sulfide and carbon disulfide;
- (b) cooling the hydrogenated gas stream to at least the dew point of water to condense water;
- (c) separating condensed water from the hydrogenated gas stream; and
- (d) treating the cooled hydrogenated gas stream to remove hydrogen sulfide.

APPENDIX E-4

CLAIM 11 OF U.S. PATENT NO. 3,752,877

11. A process as claimed in claim 8 in which the formed water and water present in the hydrogenated effluent gas stream are condensed prior to contact with the absorption solution.

APPENDIX F
EXERPT FROM FILE HISTORY

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Claims 1-5 and 8-13 are rejected as not complying with the requirements of 35 U.S.C. 112. Reference claim 1 it is not apparent how a stream of sulfur dioxide may be mixed with 70% of the stoichiometric requirement of hydrogen and essentially all of the sulfur oxide be converted to hydrogen sulfide. These limitations would appear (disclosure p. 3, lines 10-20) to be alternate procedures. Reference claim 9 it is not apparent how simple addition of carbon monoxide to sulfur dioxide will result in formation of hydrogen. Reference claims 11 and 12 it is not apparent what utility exists in removing the water from the gas stream prior to contact with an aqueous solution.

APPENDIX G
EXERPT FROM FILE HISTORY

Page 46 (Paragraphs 2 & 3)

As to claims 11 and 12, it should be evident from the disclosure that the presence of water in the gas stream would dilute an aqueous absorption solution. Removing condensed water is now required by claims 1 and 14. This, as has well been pointed out, occurs under conditions where there is essentially no sulfur dioxide present to form corrosive polythionic acids. This permits the gas stream to be introduced to an aqueous absorption solution free of water of condensation and free of corrosive compounds. In addition, the absorption solution will not be diluted by water of condensation nor consumed by chemical reaction with sulfur dioxide. Any trace amounts of sulfur dioxide which eluded hydrogenation is removed in solution with condensed water and easily controlled by the addition of alkali to the condensed water. (See page 6, line 29 et seq.)

Thus, it is respectfully submitted that significant utility exists in removing water and any trace amounts of sulfur dioxide from the gas stream prior to contact with an aqueous absorption solution.